

FOUNDATION RECOMMENDATIONS

Bridge No. 75
Columbus County, North Carolina
Tip Number: SF-230075

Prepared For:

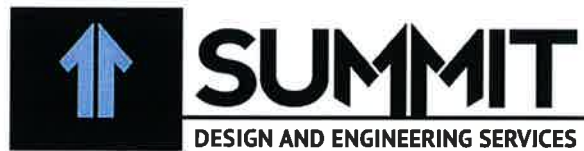


ARCADIS USA, INC.
801 Corporate Center Drive, Suite 300
Raleigh, North Carolina 27607-5075

Attention:

Mr. Steve Smallwood, P.E.
Senior Project Manager

Prepared By:



SUMMIT DESIGN AND ENGINEERING SERVICES, PLLC
504 Meadowland Drive
Hillsborough, North Carolina 27278

January 16, 2013



919.732.3883 SUMMIT-ENGINEER.COM

504 Meadowland Drive, Hillsborough, NC 27278

January 16, 2013

Arcadis USA, Inc.
801 Corporate Drive, Suite 300
Raleigh, North Carolina 27607-5073

Attention: Mr. Steve Smallwood, P.E.
Senior Project Manager

Reference: **Structure Foundation Recommendations**
Division 6 – Low Impact Bridge Replacement
Bridge No. 75
Columbus County, North Carolina
Tip Number: SF-230075
Summit Project No. 12-0265.040

Dear Mr. Smallwood:

Summit Design and Engineering Services, PLLC (Summit) is pleased to present our foundation recommendations, calculations, and subsurface report for the above referenced project.

We appreciate the opportunity to provide our professional engineering services on this project. Should you have any questions concerning this report or if we may be of further assistance, please contact us at your convenience.

Sincerely,
SUMMIT DESIGN AND ENGINEERING SERVICES, PLLC
Firm's NC License No. P-0339

A handwritten signature in blue ink, appearing to read "Harold Pruitt".

Harold Pruitt, P.E.
Chief Geotechnical Design Engineer
N.C. Registration No. 9551
harold.pruitt@summitde.net

FOUNDATION RECOMMENDATIONS

PROJECT 17BP.6.R.20

DESCRIPTION _____

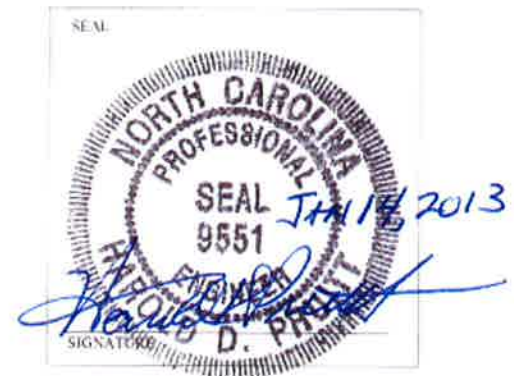
T.I.P. NO. SF-230075

Bridge No. 75 on SR1006 over Big Branch

COUNTY Columbus

STATION 13+32.50 -L-

	INITIALS	DATE
DESIGN	HDP	1/14/2013
CHECKED	DCD	1/14/2013
FINAL	HDP	1/14/2013



	STATION	FOUNDATION TYPE	FACTORED RESISTANCE	MISCELLANEOUS DETAILS
END BENT 1	13+03.88 -L-	Cap on 12 x 53 steel piles	75 tons/pile	Bottom of Cap Elevation = 35.42 +/- Estimated Tip Elevation = -1.6 feet Estimated Average Pile Length = 40 feet* 7 piles in End Bent 1
END BENT 2	13+61.13 -L-	Cap on 12 x 53 steel piles	75 tons/pile	Bottom of Cap Elevation = 35.59 feet +/- Estimated Tip Elevation = -6.4 feet Estimated Average Pile Length = 45 feet* 7 piles in End Bent 2

* Estimated Average Pile Length includes a 1-foot embedment into the Cap

COMMENTS & NOTES (See Following Page)

FOUNDATION RECOMMENDATION NOTE ON PLANS AND COMMENTS

PROJECT: 17BP.6.R.20 TIP NO: SF-230075 COUNTY: Columbus

STATION: 13+32.50 -L-

DESCRIPTION: Bridge No. 75 on SR 1006 over Big Branch

Note on Plans:

1. For piles, see Section 450 of the Standard Specifications
2. Piles at End Bent No. 1 are designed for a factored resistance of 75 tons per pile. Drive piles to a required driving resistance of 125 tons.
3. Piles at End Bent No. 2 are designed for a factored resistance of 75 tons per pile. Drive piles to a required driving resistance of 125 tons.
4. Steel H-Pile points are required for steel H-Piles at End Bent No. 1 and End Bent No. 2. For steel piles points, see Section 450 of the Standard Specifications.
5. Testing piles with the pile driving analyzer (PDA) during driving, restriking or redriving may be required. The Engineer will determine the need for PDA testing. For PDA testing, see Section 450 of the Standard Specifications.
6. It has been estimated that a hammer with an equivalent rated energy in the range of 40 to 45 ft-kips per blow will be required to drive piles at End Bent No. 1 and End Bent No. 2. This estimated energy range does not release the contractor from providing equipment in accordance with the pile provision.

Comments:

1. Use 1.5 : 1 (H:V) End Bent slopes with Class II Rip-Rap slope protection.
2. Reinforced bridge approach fills are required.

PILE PAY ITEMS

(For 2012 Lettings and Later - Revised 4/18/11)

WBS ELEMENT	17BP.6.R.20	DATE	1/14/2013
TIP NO.	SF-230075	DESIGNED BY	H. Pruitt
COUNTY	Columbus	CHECKED BY	D. Dewey
STATION	13+32.50 -L-		
DESCRIPTION Bridge No. 75 on SR 1006 over Big Branch			

NUMBER OF BENTS WITH PILES _____
 NUMBER OF PILES PER BENT _____
 NUMBER OF END BENTS WITH PILES _____
 NUMBER OF PILES PER END BENT _____

Only required for "Predrilling
for Piles" & "Pile Excavation"
pay items

Bent # or End Bent #	PILE PAY ITEM QUANTITIES						
	Steel Pile Points (yes/no)	Pipe Pile Plates (yes/no/maybe)	Predrilling For Piles (per linear ft)	Pile Redrives (per each)	Pile Excavation (per linear ft)		PDA Testing (per each)
					In Soil	Not In Soil	
End Bent 1	yes			2			
End Bent 2	yes			2			
TOTALS			0	4	0	0	1

Notes:

Blanks or "no" represent quantity of zero.

If steel pile points are required, calculate quantity of "Steel Pile Points" as equal to the number of steel piles.

If pipe pile plates are or may be required, calculate the quantity of "Pipe Pile Plates" as equal to the number of pipe piles.

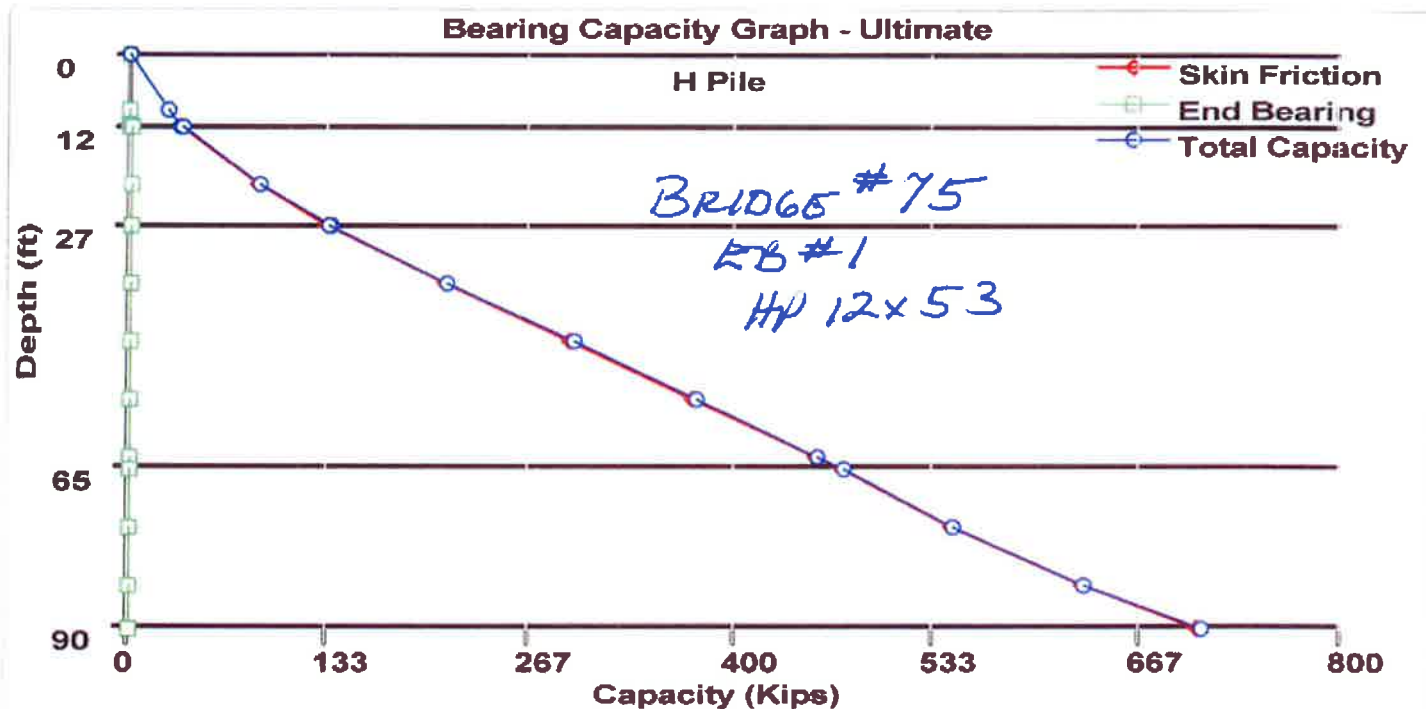
If PDA testing may be required, show quantities of "PDA Testing" on the substructure plans as totals only. If PDA testing is required, show quantities of "PDA Testing" on the substructure plans for each bent or end bent.

DESIGN SUMMARY

WBS ELEMENT 17BP.6.R.20 DATE 1/14/2013
TIP NUMBER SF-230075 DESIGNED BY H. Pruitt
COUNTY Columbus CHECKED BY D. Dewey
DESCRIPTION Bridge No. 75 on SR 1006 over Big Branch
STATION 13+32.50 -L-

Bent	Elevation Top of Pile*	Estimated Tip Elevation	POF Elevation	Length of Pile	Δ at Top of Pile	Average Length
End Bent 1	36.4	-1.6	n/a	38.0	n/a	40
End Bent 2	36.6	-6.4	n/a	43.0	n/a	45

* Elevation of Top of Pile includes a 1-foot embedment into the Cap



$$R_{f_{static}} = \text{Fractured Pile Load} = 71 \text{ TONS} \Rightarrow 75 \text{ TONS (150K)}$$

CORED SCAB BRIDGE W/L = 55' + WIDTH = 33'

$$R_{n_{static}} = 150K / 0.7 = 215 \text{ KIPS}, \quad \phi_{static} = 0.7 \text{ (COASTAL PLAIN)}$$

- BOTTOM OF CAP @ EL 35.42
- DESIGN LENGTH OF PILE = 37.0'

DESIGN PILE TIP @ EL -1.6

LENGTH OF PILE = 37.0' + 1.0' (PROJECTION INTO PILE CAP) = 38.0' $\Rightarrow$ 40.0'

DRIVEN 1.2

GENERAL PROJECT INFORMATION

Filename: C:\PROGRA~1\DRIVEN\#75-EB1.DVN

Project Name: (SF-230075)-#75-EB1

Project Date: 01/14/2013

Project Client: Arcadis-US

Computed By: Harold Pruitt

Project Manager: Don Dewey

PILE INFORMATION

Pile Type: H Pile - HP12X53

Top of Pile: 0.00 ft

Perimeter Analysis: Pile

Tip Analysis: Pile Area

ULTIMATE CONSIDERATIONS

Water Table Depth At Time Of:	- Drilling:	0.00 ft
	- Driving/Restrike	0.00 ft
	- Ultimate:	0.00 ft
	- Local Scour:	0.00 ft
Ultimate Considerations:	- Long Term Scour:	0.00 ft
	- Soft Soil:	0.00 ft

ULTIMATE PROFILE

Layer	Type	Thickness	Driving Loss	Unit Weight	Strength	Ultimate Curve
1	Cohesive	11.50 ft	0.00%	120.00 pcf	600.00 psf	T-79 Steel
2	Cohesive	15.50 ft	0.00%	120.00 pcf	3000.00 psf	T-79 Steel
3	Cohesive	38.00 ft	0.00%	120.00 pcf	2000.00 psf	T-79 Steel
4	Cohesive	25.00 ft	0.00%	120.00 pcf	2000.00 psf	T-80 Same

ULTIMATE - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.03 Kips	0.58 Kips	0.61 Kips
9.01 ft	26.34 Kips	0.58 Kips	26.92 Kips
11.49 ft	33.93 Kips	0.58 Kips	34.51 Kips
11.51 ft	34.01 Kips	2.91 Kips	36.92 Kips
20.51 ft	85.44 Kips	2.91 Kips	88.35 Kips
26.99 ft	132.50 Kips	2.91 Kips	135.41 Kips
27.01 ft	132.66 Kips	1.94 Kips	134.60 Kips
36.01 ft	210.64 Kips	1.94 Kips	212.57 Kips
45.01 ft	293.72 Kips	1.94 Kips	295.66 Kips
54.01 ft	374.25 Kips	1.94 Kips	376.19 Kips
63.01 ft	454.77 Kips	1.94 Kips	456.71 Kips
64.99 ft	472.49 Kips	1.94 Kips	474.43 Kips
65.01 ft	472.66 Kips	1.94 Kips	474.60 Kips
74.01 ft	545.75 Kips	1.94 Kips	547.69 Kips
83.01 ft	630.82 Kips	1.94 Kips	632.76 Kips
89.99 ft	706.70 Kips	1.94 Kips	708.64 Kips

37'

DRIVING - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.03 Kips	0.58 Kips	0.61 Kips
9.01 ft	26.34 Kips	0.58 Kips	26.92 Kips
11.49 ft	33.93 Kips	0.58 Kips	34.51 Kips
11.51 ft	34.01 Kips	2.91 Kips	36.92 Kips
20.51 ft	85.44 Kips	2.91 Kips	88.35 Kips
26.99 ft	132.50 Kips	2.91 Kips	135.41 Kips
27.01 ft	132.66 Kips	1.94 Kips	134.60 Kips
36.01 ft	210.64 Kips	1.94 Kips	212.57 Kips
45.01 ft	293.72 Kips	1.94 Kips	295.66 Kips
54.01 ft	374.25 Kips	1.94 Kips	376.19 Kips
63.01 ft	454.77 Kips	1.94 Kips	456.71 Kips
64.99 ft	472.49 Kips	1.94 Kips	474.43 Kips
65.01 ft	472.66 Kips	1.94 Kips	474.60 Kips
74.01 ft	545.75 Kips	1.94 Kips	547.69 Kips
83.01 ft	630.82 Kips	1.94 Kips	632.76 Kips
89.99 ft	706.70 Kips	1.94 Kips	708.64 Kips

37'



NCDOT GEOTECHNICAL ENGINEERING UNIT

BORELOG REPORT

WBS 17BP.6 R.20			TIP 17BP.6 R.20			COUNTY COLUMBUS			GEOLOGIST B. Smith, GIT								
SITE DESCRIPTION Bridge No. 75 on SR 1006 over Big Branch										GROUND WTR (ft)							
BORING NO. EB1-B			STATION 13+05			OFFSET 5 ft RT			ALIGNMENT -L-			0 HR. N/A					
COLLAR ELEV. 40.1 ft			TOTAL DEPTH 70.0 ft			NORTHING 133,729			EASTING 2,085,278			24 HR. FIAD					
DRILL RIG/HAMMER EFF./DATE SUM3359 CME-450 84% 07/27/2012						DRILL METHOD Mud Rotary			HAMMER TYPE Automatic								
DRILLER L. Gonzalez-Castillo			START DATE 01/04/13			COMP. DATE 01/04/13			SURFACE WATER DEPTH N/A								
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG MOI	L O G	SOIL AND ROCK DESCRIPTION		DEPTH (ft)	
			0.5ft	0.5ft	0.5ft	0	25	50	75	100				ELEV (ft)	DEPTH (ft)		
45																	
40																	
	36.5	3.5	2	2	3										GROUND SURFACE	0.0	
35															ROADWAY EMBANKMENT	0.0	
															Asphalt and gravel	0.0	
															Brown to gray, loose to med. dense, SILTY fin SAND (A-2-4)	3.0	
															ALLUVIAL	6.0	
															Gray med stiff mod organic plastic SILTY CLAY (A-7)	6.0	
															Gray med stiff mod organic, highly plastic SANDY CLAY (A-7-6)	6.0	
30	31.5	8.5	2	3	3												
	26.5	13.5	0	0	5												
25																	
	21.5	18.5	1	9	17										COASTAL PLAIN (PEEDEE FORMATION)	16.0	
20															Dark gray v. stiff calcareous fine SANDY CLAY (A-6)	16.0	
	16.5	23.5	31	22	31												
15																	
	11.5	28.5	58	26	15										COASTAL PLAIN SEDIMENTARY ROCK (Very hard drilling interpreted as thin limestone lense)	25.6	
10															COASTAL PLAIN	25.6	
															Dark gray, hard, calcareous, fine SANDY CLAY (A-6)	30.7	
																31.8	
	6.5	33.5	6	6	8										COASTAL PLAIN SEDIMENTARY ROCK (Very hard drilling interpreted as thin limestone lense)	38.5	
5															COASTAL PLAIN	38.5	
															Dark gray, hard, calcareous, fine SANDY CLAY (A-6)	38.5	
	1.5	38.5	100/0.4												COASTAL PLAIN SEDIMENTARY ROCK (Very hard drilling interpreted as thin limestone lense)	38.5	
0															COASTAL PLAIN	38.5	
															Dark gray, hard, calcareous, fine SANDY CLAY (A-6)	41.7	
																42.4	
	-3.4	43.5	6	7	7										COASTAL PLAIN SEDIMENTARY ROCK (Very hard drilling interpreted as thin limestone lense)	53.5	
-5															COASTAL PLAIN	53.5	
															Dark gray, hard, calcareous, fine SANDY CLAY (A-6)	59.0	
	-8.4	48.5	6	7	10										COASTAL PLAIN SEDIMENTARY ROCK (Gray limestone)	59.0	
-10															COASTAL PLAIN	59.0	
															Dark gray, hard, calcareous, fine SANDY CLAY (A-6)	67.2	
	-13.4	53.5	100/0.5												COASTAL PLAIN SEDIMENTARY ROCK (Very hard drilling interpreted as thin limestone lense)	67.2	
-15															COASTAL PLAIN	67.2	
															Dark gray, hard, calcareous, fine SANDY CLAY (A-6)	67.2	
	-18.4	58.5	16	70	30/0.2										COASTAL PLAIN SEDIMENTARY ROCK (Gray limestone)	67.2	
-20															COASTAL PLAIN	67.2	
															Dark gray, hard, calcareous, fine SANDY CLAY (A-6)	67.2	
	-23.4	63.5	5	6	8										COASTAL PLAIN SEDIMENTARY ROCK (Very hard drilling interpreted as thin limestone lense)	67.2	
-25															COASTAL PLAIN	67.2	
															Dark gray, hard, calcareous, fine SANDY CLAY (A-6)	67.2	
	-28.4	68.5	6	7	8										COASTAL PLAIN SEDIMENTARY ROCK (Very hard drilling interpreted as thin limestone lense)	67.2	
															COASTAL PLAIN	67.2	
															Dark gray, hard, calcareous, fine SANDY CLAY (A-6)	67.2	
															Spring Terminated at Elevation -29.9 ft	67.2	

NCDOT BORE SINGLE 17BP.6 R.20 (COLUMBUS 75) SUMMIT GP2 NC DOT GDT 1/1/13

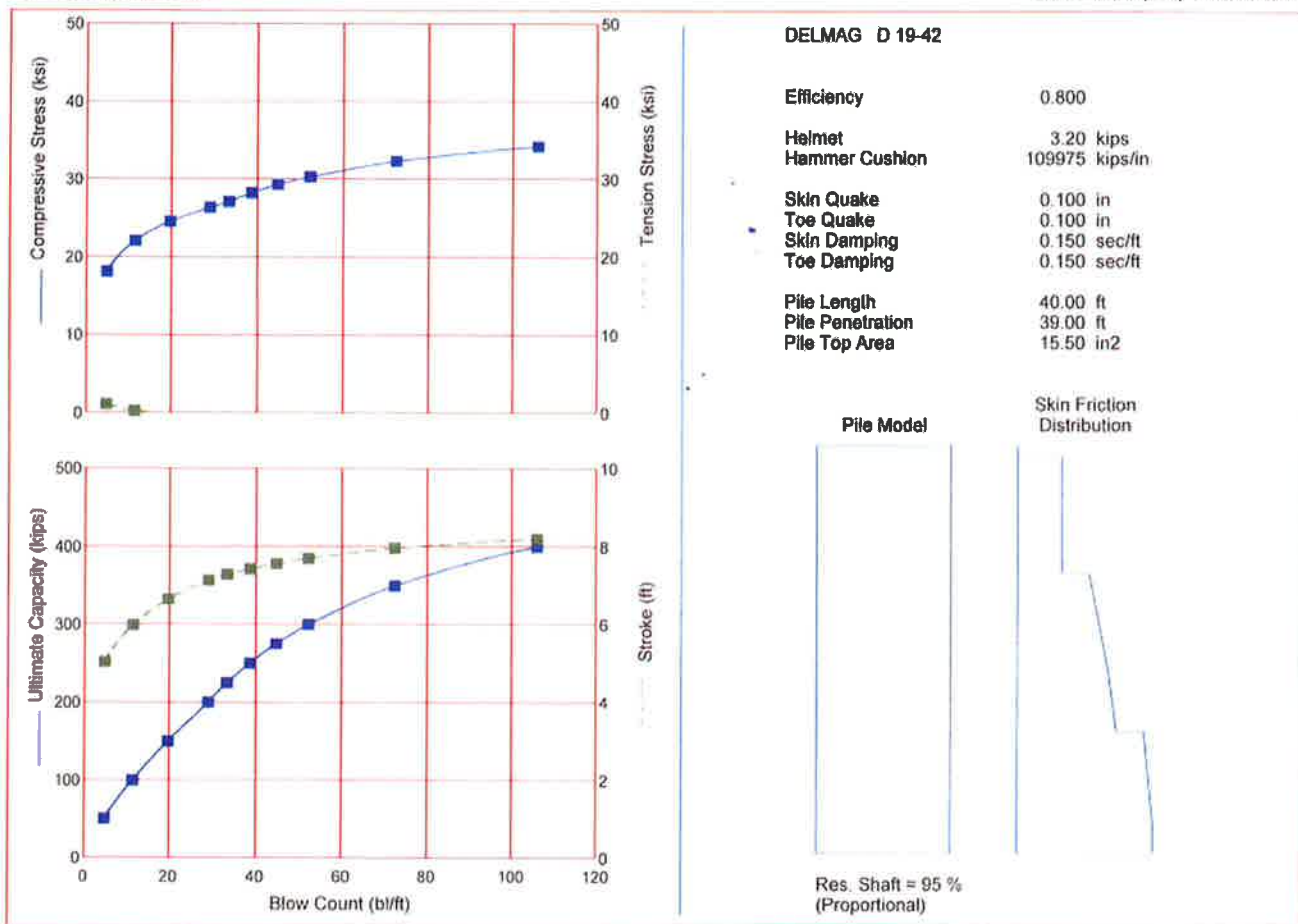
Ultimate Capacity kips	Maximum Compression Stress ksi	Maximum Tension Stress ksi	Blow Count bl/ft	Stroke ft	Energy kips-ft
50.0	18.15	1.14	4.9	5.03	20.02
100.0	22.09	0.30	11.7	5.98	17.44
150.0	24.57	0.00	19.9	6.65	16.39
200.0	26.36	0.00	29.1	7.14	16.06
225.0	27.14	0.00	33.5	7.29	15.91
250.0	28.25	0.00	38.7	7.43	15.85
275.0	29.32	0.00	44.8	7.56	15.82
300.0	30.31	0.00	52.4	7.70	15.82
350.0	32.31	0.00	72.4	7.96	16.10
400.0	34.22	0.00	106.1	8.21	16.39

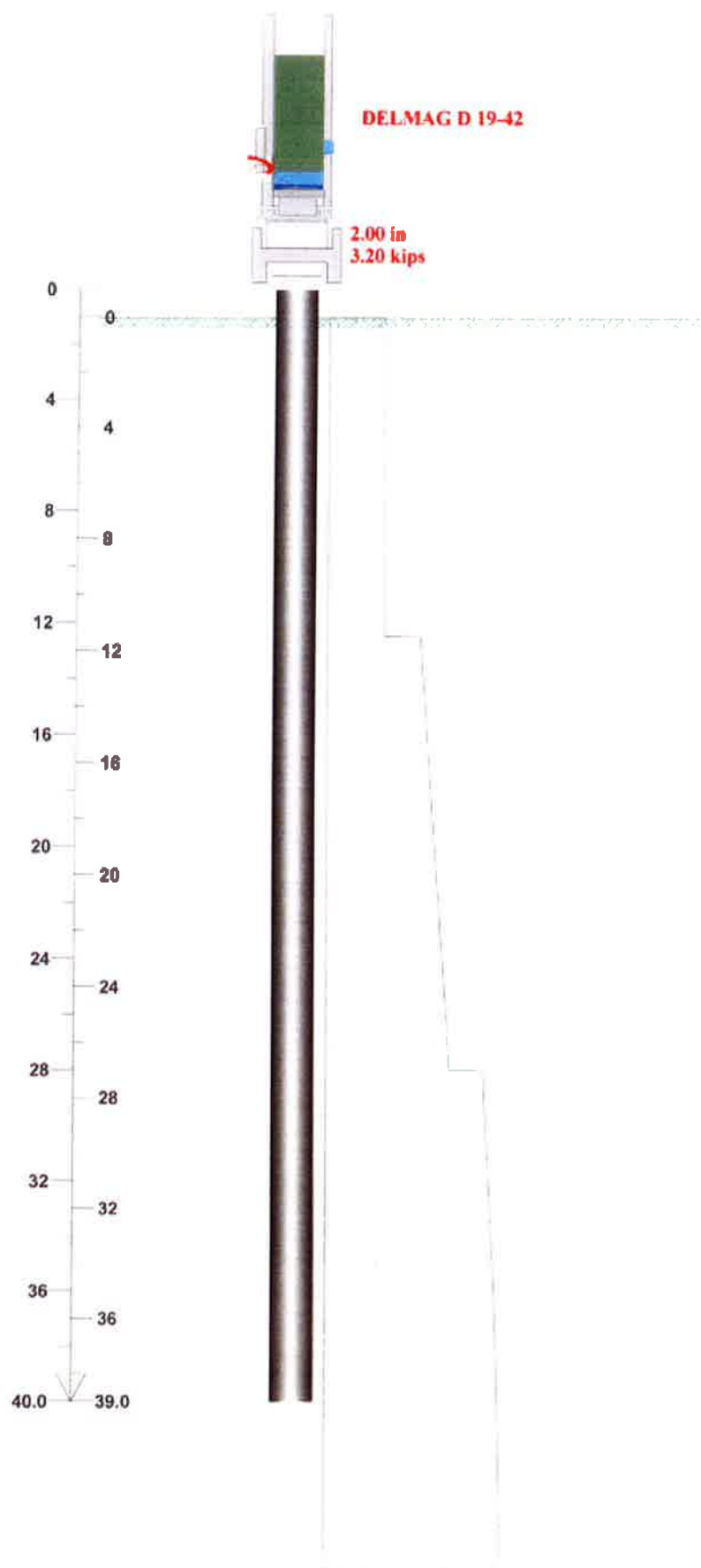
$$R_{n \text{ DRIVING}} = \frac{75^{\text{TONS}} \times 2}{0.6} = 250^{\text{KIPS}} \quad (125^{\text{TONS}})$$

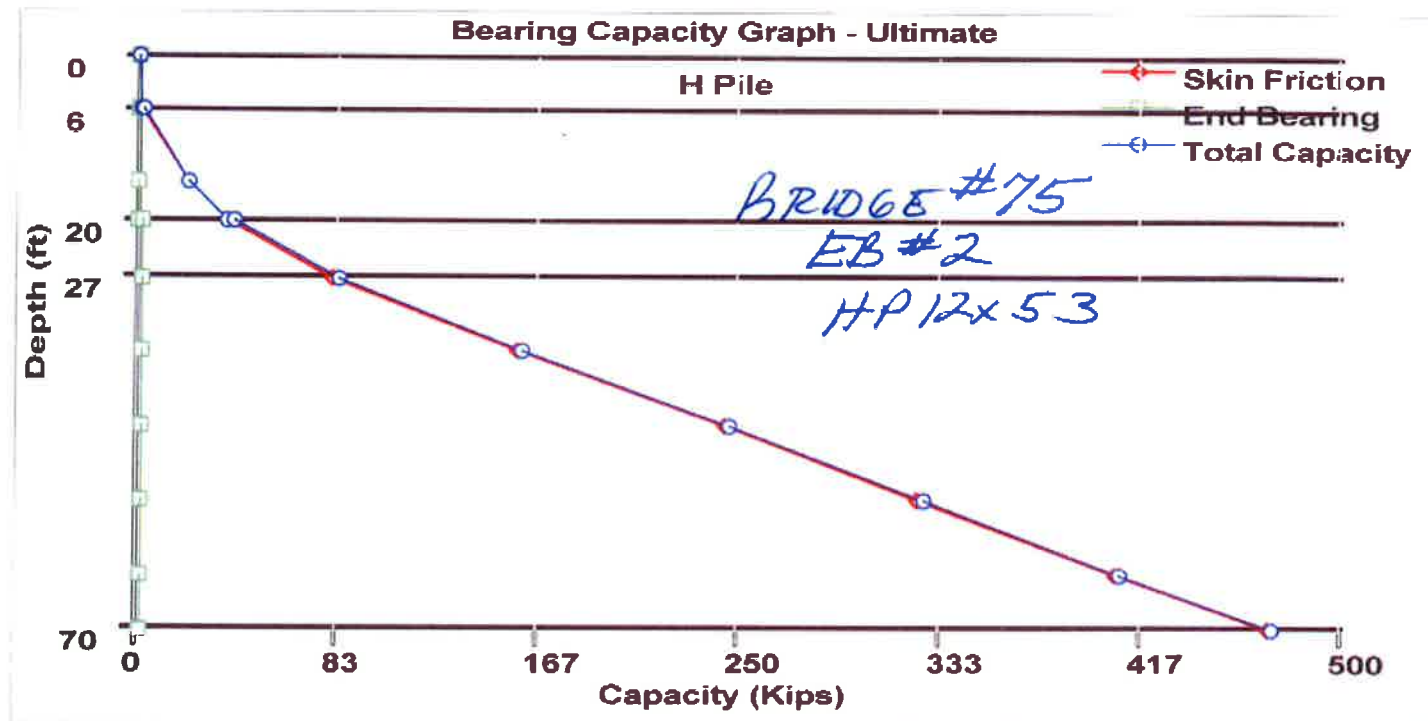
@ 250 KIPS:

- DRIVING STRESS = $28.25^{\text{KSI}} < 45^{\text{KSI}} \therefore \text{OK}$
- DRIVING BLOWS: $30^{\text{BPF}} < 39^{\text{BPF}} < 180^{\text{BPF}} \therefore \text{OK}$
- STRUCTURAL RESISTANCE = $0.66 \times 45^{\text{KSI}} \times 15.5^{\text{WT}} = 460^{\text{K}}$
 $250^{\text{K}} < 460^{\text{K}} \therefore \text{OK}$

DELMAG D19-42
(ENERGY = $43.24^{\text{K-FT}}$)







$$R_{r_{static}} = 71 \text{ TONS} \Rightarrow 75 \text{ TONS (150 KIPS)}$$

$$\phi_{static} = 0.7, \quad R_{n_{static}} = \frac{150}{0.7} = 215 \text{ KIPS}$$

- BOTTOM OF CAP @ EL 35.59
 - DESIGN LENGTH OF PILE = 42.0'
-
- DESIGN PILE TIP @ EL -6.4

$$\text{LENGTH OF PILE} = 42.0' + 1.0' \text{ (PROJECTION INTO PILE CAP)} = 43.0' \Rightarrow \underline{45'}$$

DRIVEN 1.2

GENERAL PROJECT INFORMATION

Filename: C:\PROGRA~1\DRIVEN\#75-EB2.DVN

Project Name: (SF-230075)-#75-EB2

Project Date: 01/14/2013

Project Client: Arcadis-US

Computed By: Harold Pruitt

Project Manager: Don Dewey

PILE INFORMATION

Pile Type: H Pile - HP12X53

Top of Pile: 0.00 ft

Perimeter Analysis: Pile

Tip Analysis: Pile Area

ULTIMATE CONSIDERATIONS

Water Table Depth At Time Of:	- Drilling:	0.00 ft
	- Driving/Restrike	0.00 ft
	- Ultimate:	0.00 ft
Ultimate Considerations:	- Local Scour:	0.00 ft
	- Long Term Scour:	0.00 ft
	- Soft Soil:	0.00 ft

ULTIMATE PROFILE

Layer	Type	Thickness	Driving Loss	Unit Weight	Strength	Ultimate Curve
1	Cohesionless	6.50 ft	0.00%	120.00 pcf	28.2/0.0	Nordlund
2	Cohesionless	13.50 ft	0.00%	120.00 pcf	37.3/0.0	Nordlund
3	Cohesive	7.00 ft	0.00%	120.00 pcf	3000.00 psf	T-79 Steel
4	Cohesive	43.00 ft	0.00%	120.00 pcf	2500.00 psf	T-79 Steel

DRIVING - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
6.49 ft	1.92 Kips	0.07 Kips	1.99 Kips
6.51 ft	1.94 Kips	0.07 Kips	2.01 Kips
15.51 ft	21.54 Kips	0.17 Kips	21.71 Kips
19.99 ft	37.28 Kips	0.22 Kips	37.49 Kips
20.01 ft	37.37 Kips	2.91 Kips	40.28 Kips
26.99 ft	81.78 Kips	2.91 Kips	84.69 Kips
27.01 ft	81.93 Kips	2.42 Kips	84.35 Kips
36.01 ft	159.16 Kips	2.42 Kips	161.58 Kips
45.01 ft	244.06 Kips	2.42 Kips	246.48 Kips
54.01 ft	325.12 Kips	2.42 Kips	327.54 Kips
63.01 ft	406.17 Kips	2.42 Kips	408.60 Kips
69.99 ft	469.04 Kips	2.42 Kips	471.46 Kips

ULTIMATE - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
6.49 ft	1.92 Kips	0.07 Kips	1.99 Kips
6.51 ft	1.94 Kips	0.07 Kips	2.01 Kips
15.51 ft	21.54 Kips	0.17 Kips	21.71 Kips
19.99 ft	37.28 Kips	0.22 Kips	37.49 Kips
20.01 ft	37.37 Kips	2.91 Kips	40.28 Kips
26.99 ft	81.78 Kips	2.91 Kips	84.69 Kips
27.01 ft	81.93 Kips	2.42 Kips	84.35 Kips
36.01 ft	159.16 Kips	2.42 Kips	161.58 Kips
45.01 ft	244.06 Kips	2.42 Kips	246.48 Kips
54.01 ft	325.12 Kips	2.42 Kips	327.54 Kips
63.01 ft	406.17 Kips	2.42 Kips	408.60 Kips
69.99 ft	469.04 Kips	2.42 Kips	471.46 Kips

$$\textcircled{42'} \Rightarrow 161^K + 6^{FT} \times 9.4^K/FT = 217^K > 215^K \therefore \underline{OK}$$

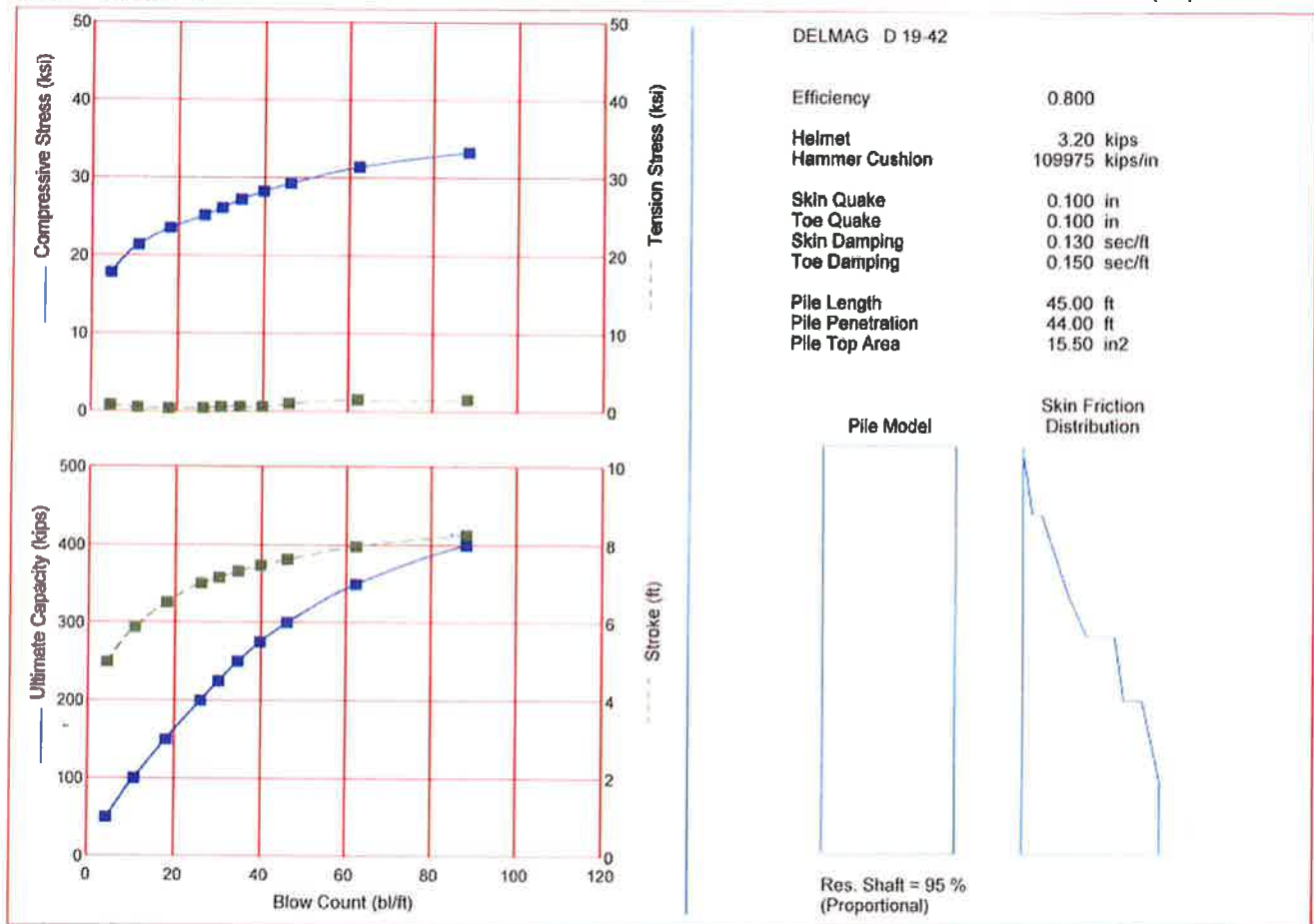
Ultimate Capacity kips	Maximum Compression Stress ksi	Maximum Tension Stress ksi	Blow Count bl/ft	Stroke ft	Energy kips-ft
50.0	17.83	0.83	4.6	4.98	20.54
100.0	21.39	0.52	10.9	5.88	17.90
150.0	23.56	0.37	18.2	6.52	16.96
200.0	25.15	0.45	26.2	7.02	16.74
225.0	26.16	0.60	30.3	7.17	16.66
250.0	27.24	0.67	34.7	7.33	16.62
275.0	28.28	0.63	39.9	7.48	16.73
300.0	29.31	1.05	46.1	7.63	16.87
350.0	31.40	1.55	62.3	7.97	17.38
400.0	33.30	1.56	88.4	8.27	18.00

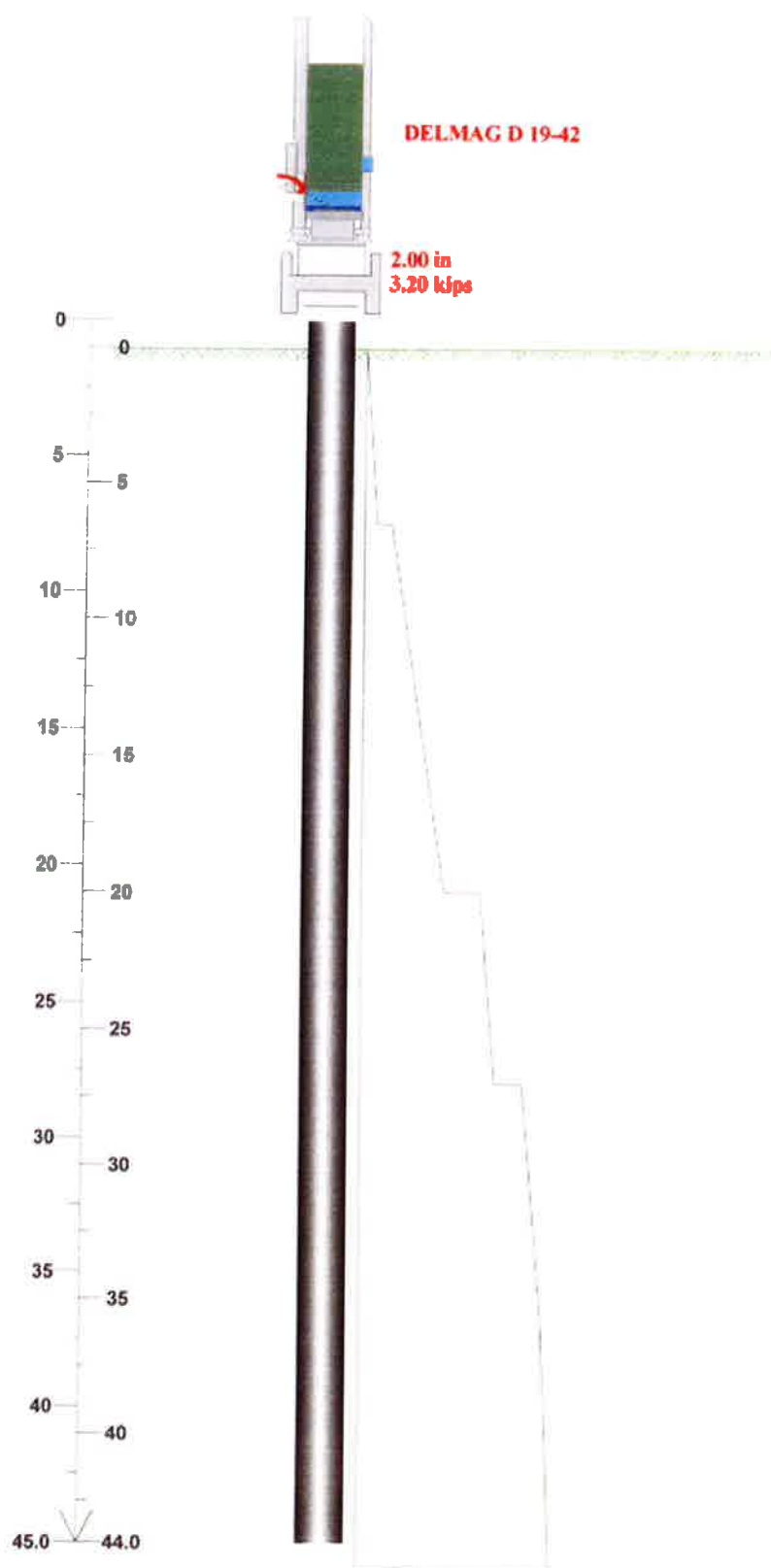
$$R_{n \text{ DRIVING}} = 250 \text{ KIPS}$$

@ 250 KIPS:

- DRIVING STRESS = $27.24 \text{ KSI} < 45 \text{ KSI} \quad \therefore \text{OK}$
- DRIVING BLOWS: $30 \text{ BPF} < 35 \text{ BPF} < 180 \text{ BPF} \quad \therefore \text{OK}$
- STRUCTURAL RESISTANCE = $0.66 \times 45 \text{ KSI} \times 15.5 \text{ in}^2 = 460 \text{ K}$
 $250 \text{ K} < 460 \text{ K} \quad \therefore \text{OK}$

DELMAG D19-42
(ENERGY = 43.24 K-FT)







NCDOT GEOTECHNICAL ENGINEERING UNIT BORELOG REPORT

SHEET 6 OF 6

WBS 17BP 6.R.20			TIP 17BP 6.R.20			COUNTY COLUMBUS			GEOLOGIST B Smith, GIT						
SITE DESCRIPTION Bridge No 75 on SR 1006 over Big Branch									GROUND WTR (ft)						
BORING NO. EB2-A			STATION 13+61			OFFSET 7 ft LT			ALIGNMENT -L-						
COLLAR ELEV. 40.0 ft			TOTAL DEPTH 74.9 ft			NORTHING 133,762			EASTING 2,085,324						
DRILL RIG/HAMMER EFF./DATE SUM3359 CME-450 84% 07/27/2012			DRILL METHOD Mud Rotary			HAMMER TYPE Automatic			24 HR. FIAD						
DRILLER L Gonzalez-Castillo			START DATE 01/03/13			COMP. DATE 01/03/13			SURFACE WATER DEPTH N/A						
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP NO	LOG	SOIL AND ROCK DESCRIPTION	DEPTH (ft)	
			0.5ft	0.5ft	0.5ft	0	25	50	75	100					
BOTTOM OF CAP @ EL 35.59															
40													40.0	GROUND SURFACE	0.0
	36.6	3.4	1	2	1								39.2	ROADWAY EMBANKMENT	0.6
														Asphalt and gravel	
														Gray and brown, v. loose, SILTY fine SAND (A-2-4)	
35													34.1	ALLUDIAL	5.9
	31.6	6.4	2	2	1									Light gray, v. loose, mod. organic, clayey, SILTY fine SAND (A-2-5)	
30													29.1	COASTAL PLAIN (PEEDEE FORMATION)	10.9
	26.6	13.4	12	13	13									White to gray, med. dense, SILTY fine SAND (A-2-4) w/ fossilized shell fragments	
25															
	21.6	18.4	25	13	13										
20															
	16.6	23.4	6	6	94/0.4										
15													15.6	COASTAL PLAIN SEDIMENTARY ROCK (Gray limestone)	24.4
	11.6	28.4	72	20	27								14.6	COASTAL PLAIN	25.4
10													11.9	Gray, stiff, calcareous, fine SANDY CLAY (A-6)	26.1
													11.1	COASTAL PLAIN SEDIMENTARY ROCK (Very hard drilling, interpreted as thin limestone lense)	26.9
	6.6	33.4	6	6	7									COASTAL PLAIN	
5														Gray, stiff, calcareous, fine SANDY CLAY (A-6)	
	1.6	38.4	12	10	11										
0															
	-3.4	43.4	5	7	15										
-5															
	-8.4	48.4	8	8	10										
-10															
	-13.4	53.4	100/0.5												
-15															
	-18.4	58.4	100/0.3												
-20															
	-23.4	63.4	6	6	12										
-25															
	-28.4	68.4	8	9	10										
-30															
	-33.4	73.4	9	9	12										

NCDOT BORE SINGLE 17BP 6.R.20 (COLUMBUS 75) SUMMIT GP J NC DOT GDT 1/10/13

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	17BP.6.R.20	1	6

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT

STRUCTURE SUBSURFACE INVESTIGATION

PROJ. REFERENCE NO. 17BP.6.R.20 F.A. PROJ. n/a
COUNTY COLUMBUS
PROJECT DESCRIPTION Br. No. 75 on SR 1006 over Big Branch

CONTENTS

SHEET	DESCRIPTION
1	TITLE SHEET
2, 2A	LEGEND
3	SITE PLAN
4-6	BORING LOGS

PERSONNEL

B. SMITH
C. HUSKETH
L. GONZALEZ-CASTILLO

INVESTIGATED BY Summit Design and Engineering
CHECKED BY D. DEWEY, PE
SUBMITTED BY Summit Design and Engineering
DATE JANUARY, 2013

CAUTION NOTICE

THE SUBSURFACE INFORMATION AND THE SUBSURFACE INVESTIGATION ON WHICH IT IS BASED WERE MADE FOR THE PURPOSE OF STUDY, PLANNING, AND DESIGN, AND NOT FOR CONSTRUCTION OR PAY PURPOSES. THE VARIOUS FIELD BORING LOGS, ROCK CORES, AND SOIL TEST DATA AVAILABLE MAY BE REVIEWED OR INSPECTED IN RALEIGH BY CONTACTING THE N.C. DEPARTMENT OF TRANSPORTATION, GEOTECHNICAL ENGINEERING UNIT AT (919) 701-6850. NEITHER THE SUBSURFACE PLANS AND REPORTS, NOR THE FIELD BORING LOGS, ROCK CORES, OR SOIL TEST DATA ARE PART OF THE CONTRACT.

GENERAL SOIL AND ROCK STRATA DESCRIPTIONS AND INDICATED BOUNDARIES ARE BASED ON A GEOTECHNICAL INTERPRETATION OF ALL AVAILABLE SUBSURFACE DATA AND MAY NOT NECESSARILY REFLECT THE ACTUAL SUBSURFACE CONDITIONS BETWEEN BORINGS OR BETWEEN SAMPLED STRATA WITHIN THE BOREHOLE. THE LABORATORY SAMPLE DATA AND THE IN SITU (IN PLACE) TEST DATA CAN BE RELIED ON ONLY TO THE DEGREE OF RELIABILITY INHERENT IN THE STANDARD TEST METHOD. THE OBSERVED WATER LEVELS OR SOIL MOISTURE CONDITIONS INDICATED IN THE SUBSURFACE INVESTIGATIONS ARE AS RECORDED AT THE TIME OF THE INVESTIGATION. THESE WATER LEVELS OR SOIL MOISTURE CONDITIONS MAY VARY CONSIDERABLY WITH TIME ACCORDING TO CLIMATIC CONDITIONS INCLUDING TEMPERATURES, PRECIPITATION, AND WIND, AS WELL AS OTHER NON-CLIMATIC FACTORS.

THE BIDDER OR CONTRACTOR IS CAUTIONED THAT DETAILS SHOWN ON THE SUBSURFACE PLANS ARE PRELIMINARY ONLY AND IN MANY CASES THE FINAL DESIGN DETAILS ARE DIFFERENT. FOR BIDDING AND CONSTRUCTION PURPOSES, REFER TO THE CONSTRUCTION PLANS AND DOCUMENTS FOR FINAL DESIGN INFORMATION ON THIS PROJECT. THE DEPARTMENT DOES NOT WARRANT OR GUARANTEE THE SUFFICIENCY OR ACCURACY OF THE INVESTIGATION MADE, NOR THE INTERPRETATIONS MADE, OR OPINION OF THE DEPARTMENT AS TO THE TYPE OF MATERIALS AND CONDITIONS TO BE ENCOUNTERED. THE BIDDER OR CONTRACTOR IS CAUTIONED TO MAKE SUCH INDEPENDENT SUBSURFACE INVESTIGATIONS AS HE DEEMS NECESSARY TO SATISFY HIMSELF AS TO CONDITIONS TO BE ENCOUNTERED ON THIS PROJECT. THE CONTRACTOR SHALL HAVE NO CLAIM FOR ADDITIONAL COMPENSATION OR FOR AN EXTENSION OF TIME FOR ANY REASON RESULTING FROM THE ACTUAL CONDITIONS ENCOUNTERED AT THE SITE DIFFERING FROM THOSE INDICATED IN THE SUBSURFACE INFORMATION.

NOTE - THE INFORMATION CONTAINED HEREIN IS NOT IMPLIED OR GUARANTEED BY THE N.C. DEPARTMENT OF TRANSPORTATION AS BEING ACCURATE NOR IS IT CONSIDERED TO BE PART OF THE PLANS, SPECIFICATIONS, OR CONTRACT FOR THE PROJECT.

NOTE - BY HAVING REQUESTED THIS INFORMATION THE CONTRACTOR SPECIFICALLY WAIVES ANY CLAIMS FOR INCREASED COMPENSATION OR EXTENSION OF TIME BASED ON DIFFERENCES BETWEEN THE CONDITIONS INDICATED HEREIN AND THE ACTUAL CONDITIONS AT THE PROJECT SITE.

DRAWN BY: B. WORLEY, PG

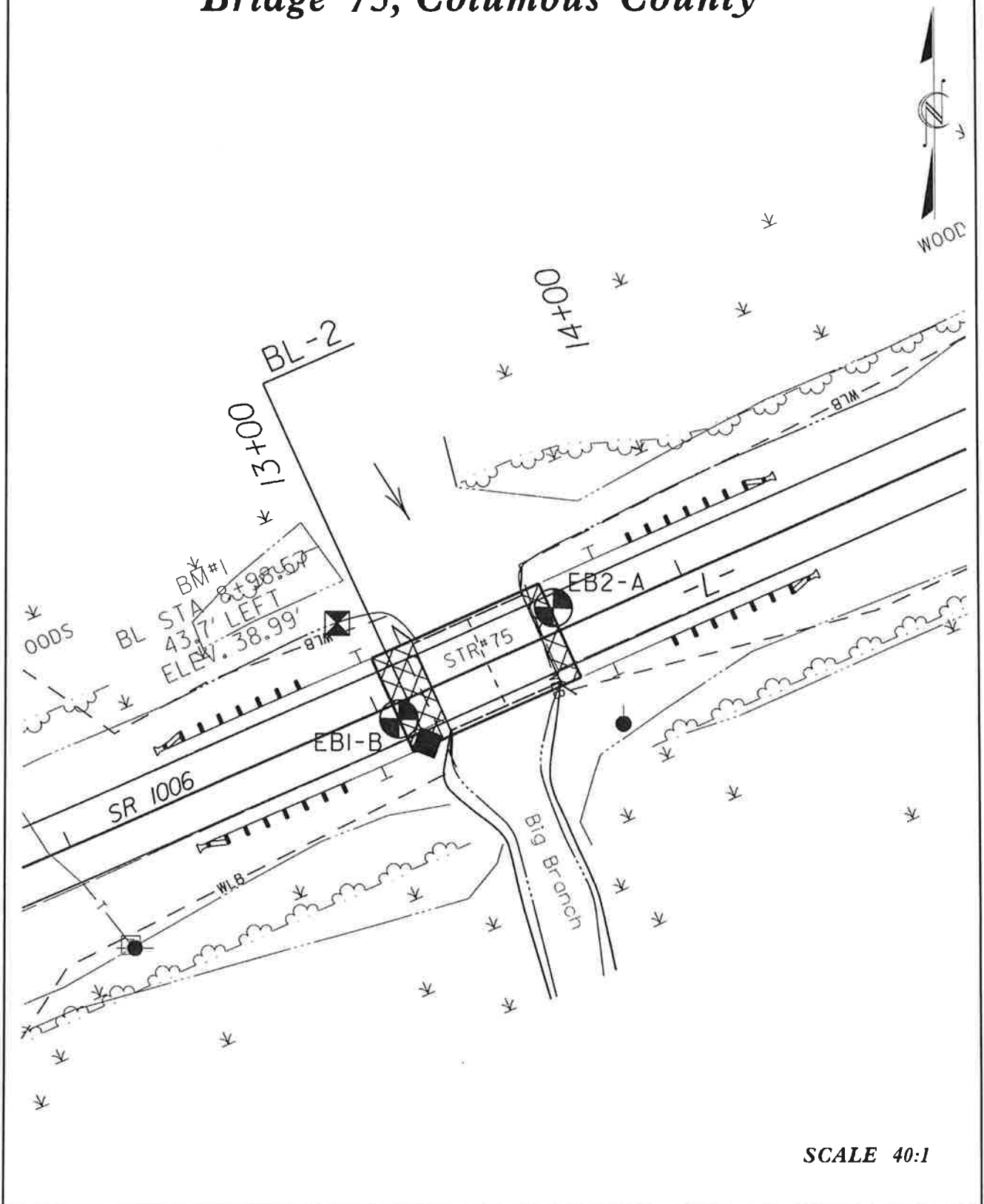


Bradley D. Worley

SITE PLAN

Bridge 75, Columbus County

STATE	STATE PROJECT NUMBER	SHEET	OF
N.C.	17BP&R20	1	6



PROJECT REFERENCE NO.

17BP.6.R.20

SHEET NO.

2

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT
SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS

SOIL DESCRIPTION

SOIL IS CONSIDERED TO BE THE UNCONSOLIDATED, SEMI-CONSOLIDATED, OR WEATHERED EARTH MATERIALS THAT CAN BE PENETRATED WITH A CONTINUOUS FLIGHT POWER AUGER, AND YIELD LESS THAN 100 BLOWS PER FOOT ACCORDING TO STANDARD PENETRATION TEST (ASTM D-1586). SOIL CLASSIFICATION IS BASED ON THE AASHTO SYSTEM. BASIC DESCRIPTIONS GENERALLY SHALL INCLUDE: CONSISTENCY, COLOR, TEXTURE, MOISTURE, AASHTO CLASSIFICATION, AND OTHER PERTINENT FACTORS SUCH AS MINERALOGICAL COMPOSITION, ANGULARITY, STRUCTURE, PLASTICITY, ETC. EXAMPLE:

VERY STIFF, GRAY, SILTY CLAY, MOST WITH INTERBEDDED FINE SAND LENSES, MOD. PLASTIC, A-7-6

SOIL LEGEND AND AASHTO CLASSIFICATION

GENERAL CLASS.	GRANULAR MATERIALS ($\leq 35\%$ PASSING #200)				SILT-CLAY MATERIALS ($> 35\%$ PASSING #200)				ORGANIC MATERIALS			
GROUP CLASS.	A-1	A-1.5	A-2	A-2.5	A-3	A-4	A-5	A-6	A-7	A-1, A-2	A-3	A-4, A-5
SYMBOL												
% PASSING	100	100	100	100	100	100	100	100	100	100	100	100
LIQUID LIMIT	5	10	15	20	25	30	35	40	45	50	55	60
PLASTIC INDEX	0	0	0	0	0	0	0	0	0	0	0	0
GROUP INDEX	0	0	0	0	0	0	0	0	0	0	0	0
USUAL TYPES OF MAJOR MATERIALS	GRAVEL, SAND, SILT, CLAY	GRAVEL, SAND, SILT, CLAY	GRAVEL, SAND, SILT, CLAY	GRAVEL, SAND, SILT, CLAY	GRAVEL, SAND, SILT, CLAY	GRAVEL, SAND, SILT, CLAY	GRAVEL, SAND, SILT, CLAY	GRAVEL, SAND, SILT, CLAY	GRAVEL, SAND, SILT, CLAY	GRAVEL, SAND, SILT, CLAY	GRAVEL, SAND, SILT, CLAY	GRAVEL, SAND, SILT, CLAY
GENERAL RATING AS A SUBGRADE	EXCELLENT TO GOOD	EXCELLENT TO GOOD	EXCELLENT TO GOOD	EXCELLENT TO GOOD	EXCELLENT TO GOOD	EXCELLENT TO GOOD	EXCELLENT TO GOOD	EXCELLENT TO GOOD	EXCELLENT TO GOOD	EXCELLENT TO GOOD	EXCELLENT TO GOOD	EXCELLENT TO GOOD

P: OF A-7-5 SUBGROUP IS $\leq LL - 30$; P: OF A-7-6 SUBGROUP IS $> LL - 30$

CONSISTENCY OR DENSENESS

PRIMARY SOIL TYPE	COMPACTNESS OR CONSISTENCY	RANGE OF STANDARD PENETRATION RESISTANCE (N-VALUE)	RANGE OF UNCONFINED COMPRESSIVE STRENGTH (TONS/FT ²)
GENERALLY GRANULAR MATERIAL (NON-COHESIVE)	VERY LOOSE LOOSE MEDIUM DENSE DENSE VERY DENSE	< 4 4 TO 10 10 TO 30 30 TO 50 > 50	N/A
GENERALLY SILT-CLAY MATERIAL (COHESIVE)	VERY SOFT SOFT MEDIUM STIFF STIFF VERY STIFF HARD	< 2 2 TO 4 4 TO 8 8 TO 15 15 TO 30 > 30	< 0.25 0.25 TO 0.50 0.5 TO 1.0 1 TO 2 2 TO 4 > 4

TEXTURE OR GRAIN SIZE

U.S. STD. SIEVE SIZE OPENING (MM)	4	10	40	60	200	270
	4.75	2.00	0.42	0.25	0.075	0.053

BOULDER (BLDR.)	COBBLE (COBL.)	GRAVEL (GR.)	COARSE SAND (CS.SD.)	FINE SAND (F.SD.)	SILT (SL.)	CLAY (CL.)
GRAIN SIZE	305	75	2.0	0.25	0.05	0.005
	IN.	IN.	IN.	IN.	IN.	IN.

SOIL MOISTURE - CORRELATION OF TERMS

SOIL MOISTURE SCALE (ATTERBERG LIMITS)	FIELD MOISTURE DESCRIPTION	GUIDE FOR FIELD MOISTURE DESCRIPTION
LL - LIQUID LIMIT	- SATURATED - (SAT.)	USUALLY LIQUID; VERY WET, USUALLY FROM BELOW THE GROUND WATER TABLE
PL - PLASTIC LIMIT	- WET - (W)	SEMI-SOLID; REQUIRES DRYING TO ATTAIN OPTIMUM MOISTURE
OM - OPTIMUM MOISTURE	- MOIST - (M)	SOLID; AT OR NEAR OPTIMUM MOISTURE
SL - SHRINKAGE LIMIT	- DRY - (D)	REQUIRES ADDITIONAL WATER TO ATTAIN OPTIMUM MOISTURE

PLASTICITY

NONPLASTIC	PLASTICITY INDEX (PI)	DRY STRENGTH
LOW PLASTICITY	0-5	VERY LOW
MED. PLASTICITY	6-15	SLIGHT
HIGH PLASTICITY	16-25	MEDIUM
	26 OR MORE	HIGH

COLOR

DESCRIPTIONS MAY INCLUDE COLOR OR COLOR COMBINATIONS (TAN, RED, YELLOW-BROWN, BLUE-GRAY). MODIFIERS SUCH AS LIGHT, DARK, STREAKED, ETC., ARE USED TO DESCRIBE APPEARANCE.

GRADATION

WELL GRADED - INDICATES A GOOD REPRESENTATION OF PARTICLE SIZES FROM FINE TO COARSE. UNIFORM - INDICATES THAT SOIL PARTICLES ARE ALL APPROXIMATELY THE SAME SIZE. (ALSO POORLY GRADED)
 GAP-GRADED - INDICATES A MIXTURE OF UNIFORM PARTICLES OF TWO OR MORE SIZES.

ANGULARITY OF GRAINS

THE ANGULARITY OR ROUNDNESS OF SOIL GRAINS IS DESIGNATED BY THE TERMS ANGULAR, SUBANGULAR, SUBROUND, OR ROUND.

MINERALOGICAL COMPOSITION

MINERAL NAMES SUCH AS QUARTZ, FELDSPAR, MICA, TALC, KAOLIN, ETC., ARE USED IN DESCRIPTIONS WHENEVER THEY ARE CONSIDERED OF SIGNIFICANCE.

COMPRESSIBILITY

SLIGHTLY COMPRESSIBLE
 MODERATELY COMPRESSIBLE
 HIGHLY COMPRESSIBLE

LIQUID LIMIT LESS THAN 31
 LIQUID LIMIT EQUAL TO 31-50
 LIQUID LIMIT GREATER THAN 50

PERCENTAGE OF MATERIAL

ORGANIC MATERIAL	GRANULAR SOILS	SILT - CLAY SOILS	OTHER MATERIAL
TRACE OF ORGANIC MATTER	2 - 3%	3 - 5%	TRACE
LITTLE ORGANIC MATTER	3 - 5%	5 - 12%	LITTLE
MODERATELY ORGANIC	5 - 10%	12 - 20%	SOME
HIGHLY ORGANIC	$> 10\%$	$> 20\%$	HIGHLY
			35% AND ABOVE

GROUND WATER

WATER LEVEL IN BORE HOLE IMMEDIATELY AFTER DRILLING
 STATIC WATER LEVEL AFTER 24 HOURS
 PERCHED WATER, SATURATED ZONE, OR WATER BEARING STRATA
 SPRING OR SEEP

MISCELLANEOUS SYMBOLS

	ROADWAY EMBANKMENT (RE) WITH SOIL DESCRIPTION		TEST BORING
	SOIL SYMBOL		AUGER BORING
	ARTIFICIAL FILL (AF) OTHER THAN ROADWAY EMBANKMENT		CORE BORING
	INFERRED SOIL BOUNDARY		MONITORING WELL
	INFERRED ROCK LINE		PIEZOMETER INSTALLATION
	ALLUVIAL SOIL BOUNDARY		SLOPE INDICATOR INSTALLATION
	DIP & DIP DIRECTION OF ROCK STRUCTURES		CONE PENETROMETER TEST
			SOUNDING ROD

ABBREVIATIONS

AR - AUGER REFUSAL	MD - MEDIUM	VST - VANE SHEAR TEST
BT - BORING TERMINATED	MICA - MICACEOUS	WEA - WEATHERED
CL - CLAY	MOD - MODERATELY	W - UNIT WEIGHT
CPT - CONE PENETRATION TEST	NP - NON PLASTIC	W _s - DRY UNIT WEIGHT
CSE - COARSE	ORG - ORGANIC	
DMT - DILATOMETER TEST	PMT - PRESSUREMETER TEST	SAMPLE ABBREVIATIONS
DPT - DYNAMIC PENETRATION TEST	SAP - SAPROLITIC	S - BULK
• - VOID RATIO	SD - SAND, SANDY	SS - SPLIT SPOON
• - FINE	SL - SILT, SILTY	ST - SHELBY TUBE
FOSS - FOSSILIFEROUS	SLI - SLIGHTLY	RS - ROCK
FRAC - FRACTURED, FRACTURES	TR - TRICONE REFUSAL	RT - RECOMPACTED TRIAXIAL
FRAG - FRAGMENTS	W - MOISTURE CONTENT	CBR - CALIFORNIA BEARING RATIO
HL - HIGHLY	V - VERY	

EQUIPMENT USED ON SUBJECT PROJECT

DRILL UNITS:	ADVANCING TOOLS:	HAMMER TYPE:
☐ MOBILE B-	☐ CLAY BITS	☒ AUTOMATIC ☐ MANUAL
☐ BK-51	☐ 6" CONTINUOUS FLIGHT AUGER	CORE SIZE:
☒ CME-450	☐ 8" HOLLOW AUGERS	☐ B
☐ CME-550	☐ HARD FACED FINGER BITS	☐ N
☐ PORTABLE HOIST	☐ TUNG-CARBIDE INSERTS	☐ H
	☐ CASING ☐ W/ ADVANCER	HAND TOOLS:
	☐ TRICONE ☐ STEEL TEETH	☐ POST HOLE DIGGER
	☒ TRICONE 2 1/8" TUNG-CARB.	☐ HAND AUGER
	☐ CORE BIT	☐ SOUNDING ROD
	☒ MUD ROTARY	☐ VANE SHEAR TEST

REVISED 09/23/09

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT
SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS

ROCK DESCRIPTION		TERMS AND DEFINITIONS	
HARD ROCK IS NON-COASTAL PLAIN MATERIAL THAT IF TESTED, WOULD YIELD SPT REFUSAL, AN INFERRED ROCK LINE INDICATES THE LEVEL AT WHICH NON-COASTAL PLAIN MATERIAL WOULD YIELD SPT REFUSAL. SPT REFUSAL IS PENETRATION BY A SPLIT SPOON SAMPLER EQUAL TO OR LESS THAN 0.1 FOOT PER 60 BLOWS. IN NON-COASTAL PLAIN MATERIAL, THE TRANSITION BETWEEN SOIL AND ROCK IS OFTEN REPRESENTED BY A ZONE OF WEATHERED ROCK. ROCK MATERIALS ARE TYPICALLY DIVIDED AS FOLLOWS:			
WEATHERED ROCK (WR)		NON-COASTAL PLAIN MATERIAL THAT WOULD YIELD SPT N VALUES > 120 BLOWS PER FOOT IF TESTED.	
CRYSTALLINE ROCK (CR)		FINE TO COARSE GRAIN IGNEOUS AND METAMORPHIC ROCK THAT WOULD YIELD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES GRANITES, GNEISS, GABBRO, SCHIST, ETC.	
NON-CRYSTALLINE ROCK (NCR)		FINE TO COARSE GRAIN METAMORPHIC AND NON-COASTAL PLAIN SEDIMENTARY ROCK THAT WOULD YIELD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES PHYLLITE, SLATE, SANDSTONE, ETC.	
COASTAL PLAIN SEDIMENTARY ROCK (CP)		COASTAL PLAIN SEDIMENTS CEMENTED INTO ROCK, BUT MAY NOT YIELD SPT REFUSAL. ROCK TYPE INCLUDES LIMESTONE, SANDSTONE, CEMENTED SHELL BEDS, ETC.	
WEATHERING			
FRESH	ROCK FRESH, CRYSTALS BRIGHT, FEW JOINTS MAY SHOW SLIGHT STAINING, ROCK RINGS UNDER HAMMER IF CRYSTALLINE.		
VERY SLIGHT (V SLT.)	ROCK GENERALLY FRESH, JOINTS STAINED, SOME JOINTS MAY SHOW THIN CLAY COATINGS IF OPEN. CRYSTALS ON A BROKEN SPECIMEN FACE SHINE BRIGHTLY, ROCK RINGS UNDER HAMMER BLOWS IF OF A CRYSTALLINE NATURE.		
SLIGHT (SLT.)	ROCK GENERALLY FRESH, JOINTS STAINED AND DISCOLORATION EXTENDS INTO ROCK UP TO 1 INCH. OPEN JOINTS MAY CONTAIN CLAY. IN GRANITOID ROCKS SOME OCCASIONAL FELDSPAR CRYSTALS ARE DULL AND DISCOLORED, CRYSTALLINE ROCKS RING UNDER HAMMER BLOWS.		
MODERATE (MOD.)	SIGNIFICANT PORTIONS OF ROCK SHOW DISCOLORATION AND WEATHERING EFFECTS. IN GRANITOID ROCKS, MOST FELDSPARS ARE DULL AND DISCOLORED, SOME SHOW CLAY. ROCK HAS DULL SOUND UNDER HAMMER BLOWS AND SHOWS SIGNIFICANT LOSS OF STRENGTH AS COMPARED WITH FRESH ROCK.		
MODERATELY SEVERE (MOD. SEV.)	ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED, IN GRANITOID ROCKS, ALL FELDSPARS DULL AND DISCOLORED AND A MAJORITY SHOW KAOLINIZATION. ROCK SHOWS SEVERE LOSS OF STRENGTH AND CAN BE EXCAVATED WITH A GEOLOGIST'S PICK. ROCK GIVES "CLUNK" SOUND WHEN STRUCK, <u>IF TESTED, WOULD YIELD SPT REFUSAL</u> .		
SEVERE (SEV.)	ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED, ROCK FABRIC CLEAR AND EVIDENT BUT REDUCED IN STRENGTH TO STRONG SOIL. IN GRANITOID ROCKS ALL FELDSPARS ARE KAOLINIZED TO SOME EXTENT. SOME FRAGMENTS OF STRONG ROCK USUALLY REMAIN, <u>IF TESTED, YIELDS SPT N VALUES > 100 BPF</u> .		
VERY SEVERE (V SEV.)	ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED, ROCK FABRIC ELEMENTS ARE DISCERNIBLE BUT THE MASS IS EFFECTIVELY REDUCED TO SOIL STATUS, WITH ONLY FRAGMENTS OF STRONG ROCK REMAINING. SAPROLITE IS AN EXAMPLE OF ROCK WEATHERED TO A DEGREE SUCH THAT ONLY MINOR VESTIGES OF THE ORIGINAL ROCK FABRIC REMAIN. <u>IF TESTED, YIELDS SPT N VALUES < 100 BPF</u> .		
COMPLETE	ROCK REDUCED TO SOIL, ROCK FABRIC NOT DISCERNIBLE, OR DISCERNIBLE ONLY IN SMALL AND SCATTERED CONCENTRATIONS. QUARTZ MAY BE PRESENT AS DIKES OR STRINGERS. SAPROLITE IS ALSO AN EXAMPLE.		
ROCK HARDNESS			
VERY HARD	CANNOT BE SCRATCHED BY KNIFE OR SHARP PICK. BREAKING OF HAND SPECIMENS REQUIRES SEVERAL HARD BLOWS OF THE GEOLOGIST'S PICK.		
HARD	CAN BE SCRATCHED BY KNIFE OR PICK ONLY WITH DIFFICULTY. HARD HAMMER BLOWS REQUIRED TO DETACH HAND SPECIMEN.		
MODERATELY HARD	CAN BE SCRATCHED BY KNIFE OR PICK. GOUGES OR GROOVES TO 0.25 INCHES DEEP CAN BE EXCAVATED BY HARD BLOW OF A GEOLOGIST'S PICK. HAND SPECIMENS CAN BE DETACHED BY MODERATE BLOWS.		
MEDIUM HARD	CAN BE GROOVED OR GOUGED 0.05 INCHES DEEP BY FIRM PRESSURE OF KNIFE OR PICK POINT. CAN BE EXCAVATED IN SMALL CHIPS TO PIECES 1 INCH MAXIMUM SIZE BY HARD BLOWS OF THE POINT OF A GEOLOGIST'S PICK.		
SOFT	CAN BE GROOVED OR GOUGED READILY BY KNIFE OR PICK. CAN BE EXCAVATED IN FRAGMENTS FROM CHIPS TO SEVERAL INCHES IN SIZE BY MODERATE BLOWS OF A PICK POINT. SMALL, THIN PIECES CAN BE BROKEN BY FINGER PRESSURE.		
VERY SOFT	CAN BE CARVED WITH KNIFE. CAN BE EXCAVATED READILY WITH POINT OF PICK. PIECES 1 INCH OR MORE IN THICKNESS CAN BE BROKEN BY FINGER PRESSURE. CAN BE SCRATCHED READILY BY FINGER NAIL.		
FRACTURE SPACING		BEDDING	
TERM	SPACING	TERM	THICKNESS
VERY WIDE	MORE THAN 10 FEET	VERY THICKLY BEDDED	> 4 FEET
WIDE	3 TO 10 FEET	THICKLY BEDDED	1.5 - 4 FEET
MODERATELY CLOSE	1 TO 3 FEET	THINLY BEDDED	0.16 - 1.5 FEET
CLOSE	0.16 TO 1 FEET	VERY THINLY BEDDED	0.03 - 0.16 FEET
VERY CLOSE	LESS THAN 0.16 FEET	THICKLY LAMINATED	0.008 - 0.03 FEET
		THINLY LAMINATED	< 0.008 FEET
INDURATION			
FOR SEDIMENTARY ROCKS, INDURATION IS THE HARDENING OF THE MATERIAL BY CEMENTING, HEAT, PRESSURE, ETC.			
FRIABLE	RUBBING WITH FINGER FREES NUMEROUS GRAINS; GENTLE BLOW BY HAMMER DISINTEGRATES SAMPLE.		
MODERATELY INDURATED	GRAINS CAN BE SEPARATED FROM SAMPLE WITH STEEL PROBE; BREAKS EASILY WHEN HIT WITH HAMMER.		
INDURATED	GRAINS ARE DIFFICULT TO SEPARATE WITH STEEL PROBE; DIFFICULT TO BREAK WITH HAMMER.		
EXTREMELY INDURATED	SHARP HAMMER BLOWS REQUIRED TO BREAK SAMPLE; SAMPLE BREAKS ACROSS GRAINS.		

ALLUVIUM (ALLUV.) - SOILS THAT HAVE BEEN TRANSPORTED BY WATER.	
AQUIFER - A WATER BEARING FORMATION OR STRATA.	
ARENACEOUS - APPLIED TO ROCKS THAT HAVE BEEN DERIVED FROM SAND OR THAT CONTAIN SAND.	
ARGILLACEOUS - APPLIED TO ALL ROCKS OR SUBSTANCES COMPOSED OF CLAY MINERALS, OR HAVING A NOTABLE PROPORTION OF CLAY IN THEIR COMPOSITION, AS SHALE, SLATE, ETC.	
ARTESIAN - GROUND WATER THAT IS UNDER SUFFICIENT PRESSURE TO RISE ABOVE THE LEVEL AT WHICH IT IS ENCOUNTERED, BUT WHICH DOES NOT NECESSARILY RISE TO OR ABOVE THE GROUND SURFACE.	
CALCAREOUS (CALC.) - SOILS THAT CONTAIN APPRECIABLE AMOUNTS OF CALCIUM CARBONATE.	
COLLUVIUM - ROCK FRAGMENTS MIXED WITH SOIL DEPOSITED BY GRAVITY ON SLOPE OR AT BOTTOM OF SLOPE.	
CORE RECOVERY (REC.) - TOTAL LENGTH OF ALL MATERIAL RECOVERED IN THE CORE BARREL DIVIDED BY TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE.	
DIKE - A TABULAR BODY OF IGNEOUS ROCK THAT CUTS ACROSS THE STRUCTURE OF ADJACENT ROCKS OR CUTS MASSIVE ROCK.	
DIP - THE ANGLE AT WHICH A STRATUM OR ANY PLANAR FEATURE IS INCLINED FROM THE HORIZONTAL.	
DIP DIRECTION (DIP AZIMUTH) - THE DIRECTION OR BEARING OF THE HORIZONTAL TRACE OF THE LINE OF DIP, MEASURED CLOCKWISE FROM NORTH.	
FAULT - A FRACTURE OR FRACTURE ZONE ALONG WHICH THERE HAS BEEN DISPLACEMENT OF THE SIDES RELATIVE TO ONE ANOTHER PARALLEL TO THE FRACTURE.	
FISSILE - A PROPERTY OF SPLITTING ALONG CLOSELY SPACED PARALLEL PLANES.	
FLOAT - ROCK FRAGMENTS ON SURFACE NEAR THEIR ORIGINAL POSITION AND DISLODGED FROM PARENT MATERIAL.	
FLOOD PLAIN (FP) - LAND BORDERING A STREAM, BUILT OF SEDIMENTS DEPOSITED BY THE STREAM.	
FORMATION (FML) - A MAPPABLE GEOLOGIC UNIT THAT CAN BE RECOGNIZED AND TRACED IN THE FIELD.	
JOINT - FRACTURE IN ROCK ALONG WHICH NO APPRECIABLE MOVEMENT HAS OCCURRED.	
LEDGE - A SHELF-LIKE RIDGE OR PROJECTION OF ROCK WHOSE THICKNESS IS SMALL COMPARED TO ITS LATERAL EXTENT.	
LENS - A BODY OF SOIL OR ROCK THAT THINS OUT IN ONE OR MORE DIRECTIONS.	
MOTTLED (MOT.) - IRREGULARLY MARKED WITH SPOTS OF DIFFERENT COLORS. MOTTLING IN SOILS USUALLY INDICATES POOR AERATION AND LACK OF GOOD DRAINAGE.	
PERCHED WATER - WATER MAINTAINED ABOVE THE NORMAL GROUND WATER LEVEL BY THE PRESENCE OF AN INTERVENING IMPERVIOUS STRATUM.	
RESIDUAL (RES.) SOIL - SOIL FORMED IN PLACE BY THE WEATHERING OF ROCK.	
ROCK QUALITY DESIGNATION (RQD) - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE.	
SAPROLITE (SAP.) - RESIDUAL SOIL THAT RETAINS THE RELIC STRUCTURE OR FABRIC OF THE PARENT ROCK.	
SILL - AN INTRUSIVE BODY OF IGNEOUS ROCK OF APPROXIMATELY UNIFORM THICKNESS AND RELATIVELY THIN COMPARED WITH ITS LATERAL EXTENT, THAT HAS BEEN EMPLACED PARALLEL TO THE BEDDING OR SCHISTOSITY OF THE INTRUDED ROCKS.	
SLICKENSIDE - POLISHED AND STRIATED SURFACE THAT RESULTS FROM FRICTION ALONG A FAULT OR SLIP PLANE.	
STANDARD PENETRATION TEST (PENETRATION RESISTANCE) (SPT) - NUMBER OF BLOWS (N OR BPF) OF A 140 LB. HAMMER FALLING 30 INCHES REQUIRED TO PRODUCE A PENETRATION OF 1 FOOT INTO SOIL WITH A 2 INCH OUTSIDE DIAMETER SPLIT SPOON SAMPLER. SPT REFUSAL IS PENETRATION EQUAL TO OR LESS THAN 0.1 FOOT PER 60 BLOWS.	
STRATA CORE RECOVERY (SREC) - TOTAL LENGTH OF STRATA MATERIAL RECOVERED DIVIDED BY TOTAL LENGTH OF STRATUM AND EXPRESSED AS A PERCENTAGE.	
STRATA ROCK QUALITY DESIGNATION (SRQD) - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS WITHIN A STRATUM EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF STRATA AND EXPRESSED AS A PERCENTAGE.	
TOPSOIL (TS) - SURFACE SOILS USUALLY CONTAINING ORGANIC MATTER.	

BENCH MARK: BL #1	
RR spike in tree, 43.7' LT	
ELEVATION: 38.99 FT.	

NOTES:

Soils samples visually classified in the field, not lab tested.

[illegible]



NCDOT GEOTECHNICAL ENGINEERING UNIT BORELOG REPORT

SHEET 5 OF 6

WBS 17BP.6.R.20		TIP 17BP.6.R.20		COUNTY COLUMBUS		GEOLOGIST B. Smith, GIT					
SITE DESCRIPTION Bridge No. 75 on SR 1006 over Big Branch						GROUND WTR (ft)					
BORING NO. EB1-B		STATION 13+05		OFFSET 5 ft RT		ALIGNMENT -L-					
COLLAR ELEV. 40.1 ft		TOTAL DEPTH 70.0 ft		NORTHING 133,729		EASTING 2,085,278					
DRILL RIG/HAMMER EFF./DATE SUM3359 CME-450 84% 07/27/2012						DRILL METHOD Mud Rotary					
DRILLER L. Gonzalez-Castillo						HAMMER TYPE Automatic					
START DATE 01/04/13		COMP. DATE 01/04/13		SURFACE WATER DEPTH N/A							
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT		SAMP. NO.	MOI	L O G	SOIL AND ROCK DESCRIPTION
			0.5ft	0.5ft	0.5ft	0	25	50	75	100	
Match Line											
Coastal Plain, stiff, fine SANDY CLAY (A-6) (PeeDee Fm.)											



WBS 17BP.6.R.20			TIP 17BP.6.R.20			COUNTY COLUMBUS			GEOLOGIST B. Smith, GIT							
SITE DESCRIPTION Bridge No. 75 on SR 1006 over Big Branch								GROUND WTR (ft)								
BORING NO. EB2-A		STATION 13+61		OFFSET 7 ft LT		ALIGNMENT -L-		0 HR. N/A								
COLLAR ELEV. 40.0 ft		TOTAL DEPTH 74.9 ft		NORTHING 133,762		EASTING 2,085,324		24 HR. FIAD								
DRILL RIG/HAMMER EFF./DATE SUM3359 CME-450 84% 07/27/2012					DRILL METHOD Mud Rotary			HAMMER TYPE Automatic								
DRILLER L. Gonzalez-Castillo		START DATE 01/03/13		COMP. DATE 01/03/13		SURFACE WATER DEPTH N/A										
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION	DEPTH (ft)		
			0.5ft	0.5ft	0.5ft	0	25	50	75	100						
40														40.0	GROUND SURFACE	0.0
														38.2	ROADWAY EMBANKMENT	0.8
															Asphalt and gravel	
															Gray and brown, v. loose, SILTY fine SAND (A-2-4)	
35	36.6	3.4	1	2	1									34.1		5.9
															ALLUVIAL	
															Light gray, v. loose, mod. organic, clayey, SILTY fine SAND (A-2-5)	
30	31.6	8.4	2	2	1									29.1		10.9
															COASTAL PLAIN (PEEDEE FORMATION)	
															White to gray, med. dense, SILTY fine SAND (A-2-4) w/ fossilized shell fragments	
25	26.6	13.4	12	13	13											
20	21.6	18.4	25	13	13											
15	16.6	23.4	6	6	94/0.4											
															</	